

## PATENT ABSTRACTS OF JAPAN

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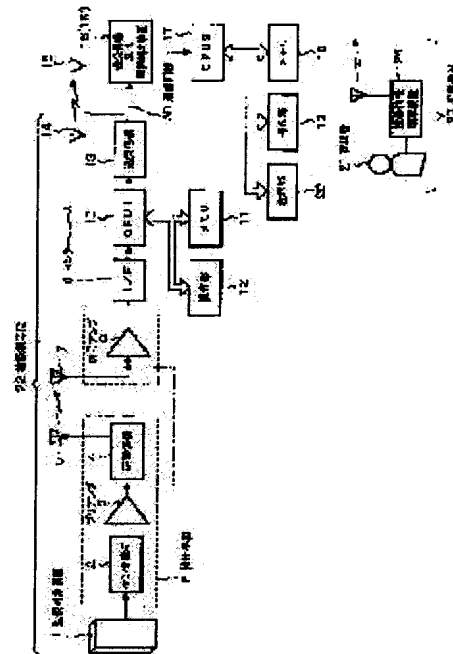
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## (54) SYSTEM AND APPARATUS FOR REMOTE MONITORING OF INDUSTRIAL EQUIPMENT

(57) Abstract:

PROBLEM TO BE SOLVED: To improve convenience for an equipment administrator by obtaining repair and/or purchase related information of the equipment, as well as operation status data information and failure prediction information of the equipment.

SOLUTION: The system always monitors the operation status of a target equipment or a facility 1 to be monitored, existing at the side of monitored means 22 via a communication line, such as the Internet, sends to an equipment administrator 21 at the side of monitoring means 23 these monitored data in the form of monthly reports or the like that are arranged at prescribed periods, and also sends failure prediction information of the equipment.



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CLAIMS

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[Claim(s)]

[Claim 1] Data concerning operating status of this industrial equipment and equipment that a sensor arranged in industrial equipment and equipment, or its neighborhood detected, In a remote monitoring system of industrial equipment which transmits to an administrator of this industrial equipment and equipment via at least one or more circuits of a wire circuit or a wireless circuit, The above-mentioned sensor the above-mentioned data concerning operating status of detected above-mentioned industrial equipment and equipment A daily report, A remote monitoring system of industrial equipment reporting integrated data information comprehensive in periods, such as a weekly report, or prior fault prediction information on this industrial equipment and equipment based on data concerning this operating status detected by the above-mentioned sensor to the above-mentioned administrator.

[Claim 2] A remote monitoring system of the industrial equipment according to claim 1 charging automatically at said administrator according to a using form of said remote monitoring system.

[Claim 3] A remote monitoring system of the industrial equipment according to claim 1 or 2 reporting simultaneously maintenance information or/and apparatus product information on said industrial equipment and equipment when reporting said prior failure information to said administrator.

[Claim 4] Based on said maintenance information which said administrator received, or/and said apparatus product information, repair of apparatus, A remote monitoring system of the industrial equipment according to claim 3, wherein repair request information and product request-for-quotation information are disseminated to a repair shop or an apparatus vendor automatically [ when it is going to perform the purchase of apparatus ].

[Claim 5] Industrial equipment and equipment, or a sensor arranged on the neighborhood detects operation data concerning operating status of this industrial machinery and equipment by a monitored means, In remote supervisory equipment of industrial equipment which transmits this operation data to a monitor means by the side of an administrator of this industrial equipment and equipment via at least one or more circuits of a wire circuit or a wireless circuit, The above-mentioned sensor the above-mentioned data information concerning operating status of detected above-mentioned industrial equipment and equipment A daily report, Remote supervisory equipment of industrial equipment accomplishing so that this integrated data information that has the integrated data information preparing means comprehensive in periods, such as a weekly report, and was acquired by the above-mentioned integrated data information preparing means may be transmitted to the above-mentioned

administrator side of the above-mentioned monitor means.

[Claim 6]Industrial equipment and equipment, or a sensor arranged on the neighborhood detects operation data concerning operating status of this industrial machinery and equipment by a monitored means, In remote supervisory equipment of industrial equipment which transmits this operation data to a monitor means by the side of an administrator of this industrial equipment and equipment via at least one or more circuits of a wire circuit or a wireless circuit, It has a fault prediction preparing means which creates prior fault prediction information on this industrial equipment and equipment based on operation data concerning this operating status detected by the above-mentioned sensor, Remote supervisory equipment of industrial equipment accomplishing so that fault prediction information on beforehand [ this ] acquired by the above-mentioned fault prediction information preparing means may be transmitted to the above-mentioned administrator side.

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DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the remote monitoring system of industrial equipment, and its remote supervisory equipment. The data information and the fault prediction information especially concerning the system operating status of apparatus are transmitted, and it is related with the remote monitoring system and remote supervisory equipment of industrial equipment which aimed at an equipment management person's improvement in convenience by disseminating the information about repair and purchase of apparatus collectively.

[0002]

[Description of the Prior Art] About the remote monitor of industrial equipment, various proposals accomplish from the former. If a facility appliance has abnormalities in JP,11-168569,A, for example, via an automatic announcement device. In order to prevent the number of times of a report from becoming big-ticket in a repeated case, if the distance from an automatic announcement device to a terminal unit becomes long when notifying the terminal unit side with an analog telephone network. The automatic announcement device accomplished so that abnormality information etc. might be transmitted using the Internet which can be managed with the phonecall charges which become settled only by a contract with a provider is indicated from the access point or subsequent ones as a means of communication.

[0003] Data transmission and reception is performed to JP,11-177576,A via a telecommunication cable between the monitor and control equipment and a monitored control device. In the supervising system which supervises the object equipment in a monitored control device, in order to reduce telecommunication cable cost etc., the radio monitoring system accomplished so that between the monitoring instruments which carry out operation management of the surveillance equipment to a monitored device might be transmitted and received via wireless communications lines is indicated.

[0004] The automatic message system is indicated by JP,11-266328,A. It is a device which notifies the abnormal condition detected with the various sensor in order to supervise the state of each facility appliance installed at the spots, such as surveillance object equipment, for example, an uninhabited robot plant etc., in this automatic message system. According to the data beforehand set up with the terminal of the monitoring center, the data of the area which should refer to a blog Lamaism bull controller is read, and as compared with the judging standard, when it judges with it being unusual, the automatic announcement device accomplished so that an automatic announcement might be

carried out is indicated.

[0005]

[Problem(s) to be Solved by the Invention]Although the abnormal condition of industrial equipment and equipment, etc. are supervised as shown in the above-stated conventional gazette, and the supervising system and monitoring instrument which were accomplished so that abnormal data information might be automatically transmitted to the monitoring center side are indicated, What planned convenience of the administrator of the monitoring center side by transmitting send data as shown in each following item is not yet reported.

[0006](1) Synthesize in periods synthesizing monitoring data, such as a daily report and a weekly report, and report the system operating status of this equipment and apparatus to an administrator.

(2) Report surveillance object equipment-failure information on forecast to an administrator a priori based on monitoring data.

(3) When reporting surveillance object equipment-failure information on forecast to an administrator a priori based on monitoring data, report simultaneously the maintenance information and the apparatus product information on surveillance object apparatus.

(4) When it is going to perform repair of apparatus and the purchase of apparatus based on the above-mentioned maintenance information which the administrator received, and apparatus product information, repair request information and product request-for-quotation information are automatically disseminated to a repair shop or an apparatus vendor.

(5) Fee collection concerning the act of (1) - (4) [0007]That is, in the surveillance of the system operating status of the remote supervisory equipment of industrial equipment, it is difficult to, grasp the operating status of apparatus and equipment on the whole in the report at the abnormal condition and generating time etc.

[0008]When surveillance object apparatus causes an accident suddenly, correspondence has a problem which is in the correspondence, when fault prediction information is not reported a priori.

[0009]It not only cannot respond to repair or purchase of apparatus promptly, but [ if the maintenance information or the apparatus product information on surveillance object apparatus are not reported ], There was a problem which takes time in the product request for quotation and repair request at the time of execution of a repair request or purchase, and cannot perform promptly accurately repair of remote monitor subject equipment and equipment, purchase, and fee collection.

[0010]Accomplishing, in order that this invention might solve an above-stated problem, Object of the Invention is that an administrator receives the various data mentioned above, and provides the system and device whose convenience improved about remuneration expenditure of profits and service which an equipment management person receives, and its service.

[0011]

[Means for Solving the Problem]This invention concerning claim 1 data concerning operating status of industrial equipment and equipment which a sensor arranged in industrial equipment and equipment, or its neighborhood detected, In a remote monitoring system of industrial equipment which transmits to an administrator of industrial equipment and equipment via at least one or more circuits of a wire circuit or a wireless circuit, A sensor data concerning operating status of detected industrial equipment and equipment A daily report, It is considered as a remote monitoring system of industrial equipment

reporting integrated data information comprehensive in periods, such as a weekly report, or prior fault prediction information on industrial equipment and equipment based on data concerning operating status detected by a sensor to an administrator.

[0012]Let this invention concerning claim 2 be a remote monitoring system of the industrial equipment according to claim 1 charging automatically at an administrator according to a using form of a remote monitoring system.

[0013]When this invention concerning claim 3 reports prior failure information to an administrator, let it be a remote monitoring system of the industrial equipment according to claim 1 or 2 reporting simultaneously maintenance information or/and apparatus product information on industrial equipment and equipment.

[0014]Based on maintenance information or/and apparatus product information which an administrator received, this invention concerning claim 4 Repair of apparatus, When it is going to perform the purchase of apparatus, repair request information and product request-for-quotation information use to be sent to a repair shop or an apparatus vendor as a remote monitoring system of the industrial equipment according to claim 3 by which it is characterized automatically.

[0015]This invention concerning claim 5 detects operation data concerning operating status of industrial machinery and equipment by a monitored means by industrial equipment and equipment, or a sensor arranged on the neighborhood, In remote supervisory equipment of industrial equipment which transmits operation data to a monitor means by the side of an administrator of industrial equipment and equipment via at least one or more circuits of a wire circuit or a wireless circuit, A sensor data information concerning operating status of detected industrial equipment and equipment A daily report, It has the integrated data information preparing means comprehensive in periods, such as a weekly report, and is considered as remote supervisory equipment of industrial equipment accomplishing so that integrated data information acquired by this integrated data information preparing means may be transmitted to the administrator side of a monitor means.

[0016]This invention concerning claim 6 detects operation data concerning operating status of industrial machinery and equipment by a monitored means by industrial equipment and equipment, or a sensor arranged on the neighborhood, In remote supervisory equipment of industrial equipment which transmits operation data to a monitor means by the side of an administrator of industrial equipment and equipment via at least one or more circuits of a wire circuit or a wireless circuit, It has a fault prediction preparing means which creates prior fault prediction information on industrial equipment and equipment based on operation data concerning operating status detected by a sensor, It is considered as remote supervisory equipment of industrial equipment accomplishing so that prior fault prediction information acquired by this fault prediction information preparing means may be transmitted to the administrator side.

[0017]According to a remote monitoring system of the industrial equipment according to claim 1 to 6, and its device, creation of reports, such as a daily report about an operation condition of apparatus and a monthly report, and issue are performed automatically, and can reduce an equipment management person's labor and equipment management cost. Fault prediction can be performed based on a database accumulated about operational status and a failure condition of apparatus in mid- and long-term. So, the unexpected situation

condition of apparatus in mid and long term Jepang, the unexpected situation of a stop of a factory line by a sudden equipment failure can be avoided, and it leads to reduction of a production cost as a result. Since a repair request and parts ordering business are performed based on information which an equipment-failure state was interlocked with, and information about a maintenance or new apparatus was automatically collected, and was collected, an effect which can reduce equipment management business and management cost is produced.

[0018]

[Embodiment of the Invention] Hereafter, the example of 1 gestalt of this invention is minutely described by drawing 1. Drawing 1 is a distribution diagram showing the overall composition of the remote monitoring system of industrial equipment.

[0019] In drawing 1, 1 is a factory, plant machinery, an uninhabited robot plant, refrigeration facilities, a boiler facility, a water supply system, disaster prevention equipments of a building, an automatic loan-application machine, a substation, plant equipment, etc. by surveillance object apparatus, and these constitute monitored apparatus and equipment.

[0020] The sensor element 2 is attached to the surveillance object apparatus 1 by the side of the monitored means 22. Or similarly the detecting signal of the sensor element 2 currently allocated near the surveillance object apparatus (it is hereafter described as apparatus) 1 is supplied to the transmitter-receiver 4 in the detection means 5 via the preamplifier 3 in the detection means 5, and is received by the antenna 7 by the side of the signal amplifier 8 allocated in about one apparatus via the antenna 6.

[0021] As composition in case sufficient output signal is acquired from the preamplifier 3 is shown and an imaginary line usually shows, the sensor element 2 -> preamplifier 3 -> signal amplifier 8 accomplishes above-mentioned composition so that a signal may be transmitted with a cable.

[0022] The analog signal from the signal amplifier 8 via ADC (analog-digital converter) in the interface (I/F) 9. It synchronizes with the time signal which a real-time clock or operation part (ALU) etc. which was changed into digital data and carried in the microcomputer (it is described as CPU<sub>1</sub> below) 10

generates. It is stored in the memories 11, such as ROM, RAM, etc. which are usually built in CPU<sub>1</sub>10 by the sampling time beforehand specified as CPU<sub>1</sub>10. In CPU<sub>1</sub>10, it has indicators, such as the final controlling elements 12, such as a keyboard, and CRT which is not illustrated. The output data of CPU<sub>1</sub>10 is outputted to the transmitter-receiver 13.

[0023] The digital output data from CPU<sub>1</sub>10 is supplied to the transmitter-receiver 13 in an analog or a digital form. The transmitter-receiver 13 of an analog is supplied via ADC (analog-digital converter) etc. which are not illustrated in order to carry out analogue conversion, The supervisory signal information by the side of the monitored means 22 is transmitted to the antenna 15 by the side of the transmitter-receiver 16 by the side of the monitor means 23 as radio signal information through the communication lines 30, such as PHS, via the antenna 14.

[0024] Or it is transmitted digitally to communication terminal device 16' via the communication line 30 which forms wire circuits, such as the Internet.

[0025] The supervisory signal information transmitted to the sending set 16 by the side of the monitor means 23 or communication terminal device 16' via CPU<sub>1</sub>10 by the side of the monitored means 22 has real time or some time lag. It

is stored in the memories 18 which it is transmitted to the transmitter-receiver 16 or communication terminal device 16', and CPU<sub>2</sub>17 usually has via the microcomputer (it is described as CPU<sub>2</sub> below) 17, such as ROM and RAM. In CPU<sub>2</sub>17, it has the final controlling elements 19, such as a keyboard, and the indicators 12, such as CRT and LCD.

[0026]This supervisory communication information may be directly transmitted via the portable telephone and the Personal Digital Assistant device (PDA:Personal Digital Assistants) 24 which the administrator 21 has.

[0027]If operation will be continued the time of being judged with the supervisory signal information stored in the memory 11 being in a failed state based on the failure decision-criterion software of the surveillance object apparatus 1 which numerical computation data processing was carried out by CPU<sub>1</sub>10, and was beforehand installed in CPU<sub>1</sub>10, and from now on, The fault prediction information that it results in failure is disseminated to about what time.

[0028]The supervisory signal information and failure information of the surveillance object apparatus 1 are linked also to CPU<sub>2</sub>17 and the memory 18, the fault prediction information on each surveillance object apparatus 1 is updated every day, and highly precise-ization of fault prediction information is attained. Creation of a period report of the daily report of the surveillance object apparatus 1, a weekly report, etc. is also performed by these CPU<sub>2</sub>17.

[0029]When disseminating fault prediction information to an administrator, the maintenance information and the apparatus product information on the surveillance object apparatus 1 are reported simultaneously, but. While the maintenance information and the apparatus product information which were related with each of the surveillance object apparatus 1 are managed by CPU<sub>2</sub>17 and reported to the administrator 21 via the communication lines 30, such as the Internet, When each information is newly updated, update information is collected via the Internet etc. and recorded on the memory 18. If the maintenance information and the product equipment information that the administrator 21 has been transmitted are accessed, On the information terminal equipment 24, such as PDA which the administrator 21 owns, the homepage by which maintenance information and product equipment information are published was displayed, and it has accomplished so that the information which the administrator 21 desires can be accessed.

[0030]Drawing 2 shows the communication system in other examples of a gestalt which applied the remote monitoring system of this invention to independent yard PHS (Personal Handyphone System). The signal amplifier 8 and the PHS transmitter-receiver 25 which transmits the amplified signal are attached to the sensor element 2. The PHS transmitter-receiver 25 transmits a signal to the terminal 26 installed in every place of premises. The signal from each terminal 26 is transmitted to PBX(Private Branch Exchang) 29 of premises via the translator 28. The comprehensive monitoring process system 29 which performs processing of the surveillance of data, collection, record, analysis, a documentation, etc. is connected to PBX28 of premises. It is connected to PHS terminal 33 which everybody hold via the translator 27 and the terminal 26 from PBX28. The public lines 30a, such as the Internet, are connected to the comprehensive supervising system 29, and the supervisory signal information



measured by the sensor element via the public line 30a may be distributed to the information terminal equipment 31, such as a personal computer which a contractor holds. It connects with the website 30a which a maintenance dealer and an equipment company manage via the public line 30a, and has composition which obtains automatically the information about a maintenance and new products of the surveillance object apparatus 1, and is distributed.

[0031]Drawing 3 shows the distribution diagram of the communication system in other examples of a gestalt which applied the remote monitoring system of this invention to public PHS. The sensor element 2, the signal amplifier 8, the PHS transmitter-receiver 25 that transmits the amplified signal, the terminal 26 installed in every place of premises, and the translator 27 are the same as that of drawing 2, and are connected to the public PHS circuit 34 from the translator 27. Supervisory signal information is transmitted to DSU (Digital Service Unit) 36 via direct or public ISDN circuit 35 from the public PHS circuit 34. The various data from the comprehensive supervising system 29 which relayed the terminal adopter 37 and was minutely described by supervisory signal information or drawing 2 is transmitted. The case where a contractor's PHS terminal device 31 is directly alerted from the public PHS circuit 34, When alerting the information terminal equipment 31 which a contractor holds via public ISDN circuit 35 and Internet line 30a, after analyzing and judging information synthetically with the comprehensive supervising system 29 further, a contractor's information terminal 31 may be alerted. It is the same as that of drawing 2 to have composition which is connected with the website 32 which a maintenance dealer and an equipment company manage via the public lines 30a, such as the Internet, obtains automatically the information about a maintenance and new products of the surveillance object apparatus 1, and is distributed.

[0032]Based on drawing 3, the operation in the case of supervising failure of the motor in a factory line and operational status is explained below. 80 sets of motors are working, and since failure of one motor leads to the stop of the whole line in this case, before a motor carries out the outage of the motor which works in the office which a contractor holds, it needs to detect failure a priori, and needs to change it to the motor for substitution. For this reason, the sensor element 2 is installed in 80 sets of all the motors that attached the management number to each. As for each motor, the temperature of a bearing and the vibrational state of the axis of rotation are always measured, and measurement data is stored in the memory which attachment does not illustrate to the sensor element 2 (Drawing 4, 1st step ST<sub>1</sub>).

[0033]The operational status of the motor is classified into the normal state, the transition state, and the abnormal condition, and a threshold is set to each level about both temperature and vibration, and it is compared with a measurement value (2nd step ST<sub>2</sub>). When the measuring result of both temperature and a vibrational state is in an all seems well like NO of 3rd step ST<sub>3</sub>, a measurement result is transmitted once to the comprehensive supervising system 29 from the sensor element 2 attached to each motor in 1 hour (4th step ST<sub>4</sub>).

[0034]If either measuring result of temperature and a vibrational state exceeds the threshold of a normal state like YES of 3rd step ST<sub>3</sub> and it goes into a transition state (abnormal condition), transmission of a measuring result will be 1 time in 10 minutes (5th step ST<sub>5</sub>). When the measuring result transmitted once in 10 minutes suits a transition state continuously 3 times (6th step ST<sub>6</sub>), as for the comprehensive supervising system 29, the motor of relevance

sends the advisory of a purport to be inspected (7th step ST<sub>7</sub>). if an advisory is sent -- an actual observation of a motor operation state, and an urgent repair sake -- a person in charge -- the setting place of a motor -- going out (8th step ST<sub>8</sub>) -- transmission of a measuring result improves in 1 time/1 minute (9th step ST<sub>9</sub>).

[0035]By easy correspondence like lubricating oil supply, when the operational status of a motor returns to a normal state (YES of 10th step ST<sub>10</sub>), it is returned to 4th step ST<sub>4</sub>, and transmission of a measuring result returns in 1 time/1 hour. By a person's in charge urgent repair, operational status is not recovered, but when the measuring result changes from the transition state to the abnormal condition, an alarm is sent to the information terminals 33, such as PHS which a person in charge carries, from the comprehensive supervising system 29, and a change on the motor of substitution for exchange is performed (12th step ST<sub>12</sub>).

[0036]Change of the measurement condition accompanying dispatch of an advisory and an alarm and change of the operational status of a motor, It performs with the firmware written in ALU of CPU<sub>10</sub> included in the monitored means 22 side, namely, the variation order of direct measuring conditions can also be sent from the monitored means [ not the comprehensive supervising system 29 but ] 22 side. If it exchanges for an exchange motor (12th step ST<sub>12</sub>), the check of the operational status of an exchange motor will be performed (14th step ST<sub>14</sub>), and dispatch for 1 time/1 minute will be performed in the state of this initial operation (13th step ST<sub>13</sub>). Then, for right repair of an abnormal operation state motor or exchange, it connects with the website 32 of the contractor in charge via the comprehensive supervising system 29, and processing of an order of a repair article, a repair request, the request for quotation of a new article, etc. is performed (15th step ST<sub>15</sub>).

[0037]It carries out based on the measuring result transmitted one by one from the sensor element 2 attached to each motor in the comprehensive supervising system 29, The result of having synthesized the result after the alert of the advisory and alarm which were mentioned above, and repair is automatically created as a daily report and a monthly report, and it has become a system (16th step ST<sub>16</sub>) sent via the Internet etc.

[0038]The measuring result and failure information which were accumulated in the comprehensive supervising system over the long period of time are accumulated as a database, and the fault prediction information judged on a mid- and long-term basis is created by comparing the measuring result transmitted one by one from the sensor element 2, and this database.

[0039]It sends with the creation of a report and the creation of dispatch and fault prediction information which have been described above, A predetermined fee can also be charged at a contractor to service acts in connection with the maintenance and new installation which were interlocked with transmission and reception of the variety of information in connection with an operation condition, and the operation condition of apparatus, such as automatic processing of automatic information gathering, order, etc.

[0040]It makes it good to use the fault predicting system using the self-study method whose decision precision concerning the operating status of apparatus improves, so that the data accumulation amount of CPU to which above-mentioned

fault prediction information is made to output increases. Issue of the data which totals in periods, such as a daily report and a monthly report, is also largely undertaken to the accumulation apparatus of data, and data calculation, analysis and a determining function.

[0041]

[Effect of the Invention]The remote monitoring system of the industrial equipment of this invention and the effects of the device are enumerated below.

- 1) Creation of reports, such as a daily report about the operation condition of apparatus and a monthly report, and issue are performed automatically, and can reduce an equipment management person's labor and equipment management cost.
- 2) Based on the database accumulated about the operational status and the failure condition of apparatus, fault prediction can be performed in mid- and long-term Sepang, and the unexpected situation of the stop of the factory line by a sudden equipment failure can be avoided, and lead to reduction of a production cost as a result.
- 3) Since repair request and parts ordering business are performed based on the information which the equipment-failure state was interlocked with, and the information about a maintenance or new apparatus was automatically collected, and was collected, equipment management business and management cost are reducible.

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TECHNICAL FIELD

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[Field of the Invention] This invention relates to the remote monitoring system of industrial equipment, and its remote supervisory equipment, The data information and the fault prediction information especially concerning the system operating status of apparatus are transmitted, and it is related with the remote monitoring system and remote supervisory equipment of industrial equipment which aimed at an equipment management person's improvement in convenience by disseminating the information about repair and purchase of apparatus collectively.

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PRIOR ART

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[Description of the Prior Art]About the remote monitor of industrial equipment, various proposals accomplish from the former, If a facility appliance has abnormalities in JP,11-168569,A, for example, via an automatic announcement device. In order to prevent the number of times of a report from becoming big-ticket in a repeated case, if the distance from an automatic announcement device to a terminal unit becomes long when notifying the terminal unit side with an analog telephone network. The automatic announcement device accomplished so that abnormality information etc. might be transmitted using the Internet which can be managed with the phonecall charges which become settled only by a contract with a provider is indicated from the access point or subsequent ones as a means of communication.

[0003]Data transmission and reception is performed to JP,11-177576,A via a telecommunication cable between the monitor and control equipment and a monitored control device, In the supervising system which supervises the object equipment in a monitored control device, in order to reduce telecommunication cable cost etc., the radio monitoring system accomplished so that between the monitoring instruments which carry out operation management of the surveillance equipment to a monitored device might be transmitted and received via wireless communications lines is indicated.

[0004]The automatic message system is indicated by JP,11-266328,A. It is a device which notifies the abnormal condition detected with the various sensor in order to supervise the state of each facility appliance installed at the spots, such as surveillance object equipment, for example, an uninhabited robot plant etc., in this automatic message system, According to the data beforehand set up with the terminal of the monitoring center, the data of the area which should refer to a blog Lamaism bull controller is read, and as compared with the judging standard, when it judges with it being unusual, the automatic announcement device accomplished so that an automatic announcement might be carried out is indicated.

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EFFECT OF THE INVENTION

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[Effect of the Invention] The remote monitoring system of the industrial equipment of this invention and the effects of the device are enumerated below.

- 1) Creation of reports, such as a daily report about the operation condition of apparatus and a monthly report, and issue are performed automatically, and can reduce an equipment management person's labor and equipment management cost.
- 2) Based on the database accumulated about the operational status and the failure condition of apparatus, fault prediction can be performed in mid- and long-term Sepang, and the unexpected situation of the stop of the factory line by a sudden equipment failure can be avoided, and lead to reduction of a production cost as a result.
- 3) Since repair request and parts ordering business are performed based on the information which the equipment-failure state was interlocked with, and the information about a maintenance or new apparatus was automatically collected, and was collected, equipment management business and management cost are reducible.

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TECHNICAL PROBLEM

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[Problem(s) to be Solved by the Invention] Although the abnormal condition of industrial equipment and equipment, etc. are supervised as shown in the above-stated conventional gazette, and the supervising system and monitoring instrument which were accomplished so that abnormal data information might be automatically transmitted to the monitoring center side are indicated, What planned convenience of the administrator of the monitoring center side by transmitting send data as shown in each following item is not yet reported. [0006] (1) Synthesize in periods synthesizing monitoring data, such as a daily report and a weekly report, and report the system operating status of this equipment and apparatus to an administrator.

(2) Report surveillance object equipment-failure information on forecast to an administrator a priori based on monitoring data.

(3) When reporting surveillance object equipment-failure information on forecast to an administrator a priori based on monitoring data, report simultaneously the maintenance information and the apparatus product information on surveillance object apparatus.

(4) When it is going to perform repair of apparatus and the purchase of apparatus based on the above-mentioned maintenance information which the administrator received, and apparatus product information, repair request information and product request-for-quotation information are automatically disseminated to a repair shop or an apparatus vendor.

(5) Fee collection concerning the act of (1) - (4) [0007] That is, in the surveillance of the system operating status of the remote supervisory equipment of industrial equipment, it is difficult to, grasp the operating status of apparatus and equipment on the whole in the report at the abnormal condition and generating time etc.

[0008] When surveillance object apparatus causes an accident suddenly, correspondence has a problem which is in the correspondence, when fault prediction information is not reported a priori.

[0009] It not only cannot respond to repair or purchase of apparatus promptly, but [ if the maintenance information or the apparatus product information on surveillance object apparatus are not reported ], There was a problem which takes time in the product request for quotation and repair request at the time of execution of a repair request or purchase, and cannot perform promptly accurately repair of remote monitor subject equipment and equipment, purchase, and fee collection.

[0010] Accomplishing, in order that this invention might solve an above-stated problem, Object of the Invention is that an administrator receives the various data mentioned above, and provides the system and device whose convenience

improved about remuneration expenditure of profits and service which an equipment management person receives, and its service.

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MEANS

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[Means for Solving the Problem] This invention concerning claim 1 data concerning operating status of industrial equipment and equipment which a sensor arranged in industrial equipment and equipment, or its neighborhood detected, In a remote monitoring system of industrial equipment which transmits to an administrator of industrial equipment and equipment via at least one or more circuits of a wire circuit or a wireless circuit, A sensor data concerning operating status of detected industrial equipment and equipment A daily report, It is considered as a remote monitoring system of industrial equipment reporting integrated data information comprehensive in periods, such as a weekly report, or prior fault prediction information on industrial equipment and equipment based on data concerning operating status detected by a sensor to an administrator.

[0012] Let this invention concerning claim 2 be a remote monitoring system of the industrial equipment according to claim 1 charging automatically at an administrator according to a using form of a remote monitoring system.

[0013] When this invention concerning claim 3 reports prior failure information to an administrator, let it be a remote monitoring system of the industrial equipment according to claim 1 or 2 reporting simultaneously maintenance information or/and apparatus product information on industrial equipment and equipment.

[0014] Based on maintenance information or/and apparatus product information which an administrator received, this invention concerning claim 4 Repair of apparatus, When it is going to perform the purchase of apparatus, repair request information and product request-for-quotation information use to be sent to a repair shop or an apparatus vendor as a remote monitoring system of the industrial equipment according to claim 3 by which it is characterized automatically.

[0015] This invention concerning claim 5 detects operation data concerning operating status of industrial machinery and equipment by a monitored means by industrial equipment and equipment, or a sensor arranged on the neighborhood, In remote supervisory equipment of industrial equipment which transmits operation data to a monitor means by the side of an administrator of industrial equipment and equipment via at least one or more circuits of a wire circuit or a wireless circuit, A sensor data information concerning operating status of detected industrial equipment and equipment A daily report, It has the integrated data information preparing means comprehensive in periods, such as a weekly report, and is considered as remote supervisory equipment of industrial equipment accomplishing so that integrated data information acquired by this integrated data information preparing means may be transmitted to the

administrator side of a monitor means.

[0016]This invention concerning claim 6 detects operation data concerning operating status of industrial machinery and equipment by a monitored means by industrial equipment and equipment, or a sensor arranged on the neighborhood, In remote supervisory equipment of industrial equipment which transmits operation data to a monitor means by the side of an administrator of industrial equipment and equipment via at least one or more circuits of a wire circuit or a wireless circuit, It has a fault prediction preparing means which creates prior fault prediction information on industrial equipment and equipment based on operation data concerning operating status detected by a sensor, It is considered as remote supervisory equipment of industrial equipment accomplishing so that prior fault prediction information acquired by this fault prediction information preparing means may be transmitted to the administrator side.

[0017]According to a remote monitoring system of the industrial equipment according to claim 1 to 6, and its device, creation of reports, such as a daily report about an operation condition of apparatus and a monthly report, and issue are performed automatically, and can reduce an equipment management person's labor and equipment management cost. Fault prediction can be performed based on a database accumulated about operational status and a failure condition of apparatus in mid- and long-term Sepang, the unexpected situation of a stop of a factory line by a sudden equipment failure can be avoided, and it leads to reduction of a production cost as a result. Since a repair request and parts ordering business are performed based on information which an equipment-failure state was interlocked with, and information about a maintenance or new apparatus was automatically collected, and was collected, an effect which can reduce equipment management business and management cost is produced.

[0018]

[Embodiment of the Invention]Hereafter, the example of 1 gestalt of this invention is minutely described by drawing 1. Drawing 1 is a distribution diagram showing the overall composition of the remote monitoring system of industrial equipment.

[0019]In drawing 1, 1 is a factory, plant machinery, an uninhabited robot plant, refrigeration facilities, a boiler facility, a water supply system, disaster prevention equipments of a building, an automatic loan-application machine, a substation, plant equipment, etc. by surveillance object apparatus, and these constitute monitored apparatus and equipment.

[0020]The sensor element 2 is attached to the surveillance object apparatus 1 by the side of the monitored means 22. Or similarly the detecting signal of the sensor element 2 currently allocated near the surveillance object apparatus (it is hereafter described as apparatus) 1 is supplied to the transmitter-receiver 4 in the detection means 5 via the preamplifier 3 in the detection means 5, and is received by the antenna 7 by the side of the signal amplifier 8 allocated in about one apparatus via the antenna 6.

[0021]As composition in case sufficient output signal is acquired from the preamplifier 3 is shown and an imaginary line usually shows, the sensor element 2 -> preamplifier 3 -> signal amplifier 8 accomplishes above-mentioned composition so that a signal may be transmitted with a cable.

[0022]The analog signal from the signal amplifier 8 via ADC (analog-digital converter) in the interface (I/F) 9. It synchronizes with the time signal which a real-time clock or operation part (ALU) etc. which was changed into digital

data and carried in the microcomputer (it is described as CPU<sub>1</sub> below) 10 generates. It is stored in the memories 11, such as ROM, RAM, etc. which are usually built in CPU<sub>1</sub>10 by the sampling time beforehand specified as CPU<sub>1</sub>10. In CPU<sub>1</sub>10, it has indicators, such as the final controlling elements 12, such as a keyboard, and CRT which is not illustrated. The output data of CPU<sub>1</sub>10 is outputted to the transmitter-receiver 13.

[0023]The digital output data from CPU<sub>1</sub>10 is supplied to the transmitter-receiver 13 in an analog or a digital form. The transmitter-receiver 13 of an analog is supplied via ADC (analog-digital converter) etc. which are not illustrated in order to carry out analogue conversion. The supervisory signal information by the side of the monitored means 22 is transmitted to the antenna 15 by the side of the transmitter-receiver 16 by the side of the monitor means 23 as radio signal information through the communication lines 30, such as PHS, via the antenna 14.

[0024]Or it is transmitted digitally to communication terminal device 16' via the communication line 30 which forms wire circuits, such as the Internet.

[0025]The supervisory signal information transmitted to the sending set 16 by the side of the monitor means 23 or communication terminal device 16' via CPU<sub>1</sub>10 by the side of the monitored means 22 has real time or some time lag. It is stored in the memories 18 which it is transmitted to the transmitter-receiver 16 or communication terminal device 16', and CPU<sub>2</sub>17 usually has via the microcomputer (it is described as CPU<sub>2</sub> below) 17, such as ROM and RAM. In CPU<sub>2</sub>17, it has the final controlling elements 19, such as a keyboard, and the indicators 12, such as CRT and LCD.

[0026]This supervisory communication information may be directly transmitted via the portable telephone and the Personal Digital Assistant device (PDA:Personal Digital Assistants) 24 which the administrator 21 has.

[0027]If operation will be continued the time of being judged with the supervisory signal information stored in the memory 11 being in a failed state based on the failure decision-criterion software of the surveillance object apparatus 1 which numerical computation data processing was carried out by CPU<sub>1</sub>10, and was beforehand installed in CPU<sub>1</sub>10, and from now on, The fault prediction information that it results in failure is disseminated to about what time.

[0028]The supervisory signal information and failure information of the surveillance object apparatus 1 are linked also to CPU<sub>2</sub>17 and the memory 18, the fault prediction information on each surveillance object apparatus 1 is updated every day, and highly precise-ization of fault prediction information is attained. Creation of a period report of the daily report of the surveillance object apparatus 1, a weekly report, etc. is also performed by these CPU<sub>2</sub>17.

[0029]When disseminating fault prediction information to an administrator, the maintenance information and the apparatus product information on the surveillance object apparatus 1 are reported simultaneously, but. While the maintenance information and the apparatus product information which were related with each of the surveillance object apparatus 1 are managed by CPU<sub>2</sub>17 and reported to the administrator 21 via the communication lines 30, such as the Internet. When each information is newly updated, update information is

the Internet, when each information is newly updated, update information is collected via the Internet etc. and recorded on the memory 18. If the maintenance information and the product equipment information that the administrator 21 has been transmitted are accessed, On the information terminal equipment 24, such as PDA which the administrator 21 owns, the homepage by which maintenance information and product equipment information are published was displayed, and it has accomplished so that the information which the administrator 21 desires can be accessed.

[0030]Drawing 2 shows the communication system in other examples of a gestalt which applied the remote monitoring system of this invention to independent yard PHS (Personal Handyphone System). The signal amplifier 8 and the PHS transmitter-receiver 25 which transmits the amplified signal are attached to the sensor element 2. The PHS transmitter-receiver 25 transmits a signal to the terminal 26 installed in every place of premises. The signal from each terminal 26 is transmitted to PBX(Private Branch Exchange) 29 of premises via the translator 28. The comprehensive monitoring process system 29 which performs processing of the surveillance of data, collection, record, analysis, a documentation, etc. is connected to PBX28 of premises. It is connected to PHS terminal 33 which everybody hold via the translator 27 and the terminal 26 from PBX28. The public lines 30a, such as the Internet, are connected to the comprehensive supervising system 29, and the supervisory signal information measured by the sensor element via the public line 30a may be distributed to the information terminal equipment 31, such as a personal computer which a contractor holds. It connects with the website 30a which a maintenance dealer and an equipment company manage via the public line 30a, and has composition which obtains automatically the information about a maintenance and new products of the surveillance object apparatus 1, and is distributed.

[0031]Drawing 3 shows the distribution diagram of the communication system in other examples of a gestalt which applied the remote monitoring system of this invention to public PHS. The sensor element 2, the signal amplifier 8, the PHS transmitter-receiver 25 that transmits the amplified signal, the terminal 26 installed in every place of premises, and the translator 27 are the same as that of drawing 2, and are connected to the public PHS circuit 34 from the translator 27. Supervisory signal information is transmitted to DSU(Digital Service Unit) 36 via direct or public ISDN circuit 35 from the public PHS circuit 34. The various data from the comprehensive supervising system 29 which relayed the terminal adopter 37 and was minutely described by supervisory signal information or drawing 2 is transmitted. The case where a contractor's PHS terminal device 31 is directly alerted from the public PHS circuit 34, When alerting the information terminal equipment 31 which a contractor holds via public ISDN circuit 35 and Internet line 30a, after analyzing and judging information synthetically with the comprehensive supervising system 29 further, a contractor's information terminal 31 may be alerted. It is the same as that of drawing 2 to have composition which is connected with the website 32 which a maintenance dealer and an equipment company manage via the public lines 30a, such as the Internet, obtains automatically the information about a maintenance and new products of the surveillance object apparatus 1, and is distributed.

[0032]Based on drawing 3, the operation in the case of supervising failure of the motor in a factory line and operational status is explained below. 80 sets of motors are working, and since failure of one motor leads to the stop of the whole line in this case, before a motor carries out the outage of the motor which works in the office which a contractor holds, it needs to detect failure

a priori, and needs to change it to the motor for substitution. For this reason, the sensor element 2 is installed in 80 sets of all the motors that attached the management number to each. As for each motor, the temperature of a bearing and the vibrational state of the axis of rotation are always measured, and measurement data is stored in the memory which attachment does not illustrate to the sensor element 2 (Drawing 4, 1st step ST<sub>1</sub>).

[0033]The operational status of the motor is classified into the normal state, the transition state, and the abnormal condition, and a threshold is set to each level about both temperature and vibration, and it is compared with a measurement value (2nd step ST<sub>2</sub>). When the measuring result of both temperature and a vibrational state is in an all seems well like NO of 3rd step ST<sub>3</sub>, a measurement result is transmitted once to the comprehensive supervising system 29 from the sensor element 2 attached to each motor in 1 hour (4th step ST<sub>4</sub>).

[0034]If either measuring result of temperature and a vibrational state exceeds the threshold of a normal state like YES of 3rd step ST<sub>3</sub> and it goes into a transition state (abnormal condition), transmission of a measuring result will be 1 time in 10 minutes (5th step ST<sub>5</sub>). When the measuring result transmitted once in 10 minutes suits a transition state continuously 3 times (6th step ST<sub>6</sub>), as for the comprehensive supervising system 29, the motor of relevance sends the advisory of a purport to be inspected (7th step ST<sub>7</sub>). If an advisory is sent -- an actual observation of a motor operation state, and an urgent repair sake -- a person in charge -- the setting place of a motor -- going out (8th step ST<sub>8</sub>) -- transmission of a measuring result improves in 1 time/1 minute (9th step ST<sub>9</sub>).

[0035]By easy correspondence like lubricating oil supply, when the operational status of a motor returns to a normal state (YES of 10th step ST<sub>10</sub>), it is returned to 4th step ST<sub>4</sub>, and transmission of a measuring result returns in 1 time/1 hour. By a person's in charge urgent repair, operational status is not recovered, but when the measuring result changes from the transition state to the abnormal condition, an alarm is sent to the information terminals 33, such as PHS which a person in charge carries, from the comprehensive supervising system 29, and a change on the motor of substitution for exchange is performed (12th step ST<sub>12</sub>).

[0036]Change of the measurement condition accompanying dispatch of an advisory and an alarm and change of the operational status of a motor, It performs with the firmware written in ALU of CPU<sub>10</sub> included in the monitored means 22 side, namely, the variation order of direct measuring conditions can also be sent from the monitored means [ not the comprehensive supervising system 29 but ] 22 side. If it exchanges for an exchange motor (12th step ST<sub>12</sub>), the check of the operational status of an exchange motor will be performed (14th step ST<sub>14</sub>), and dispatch for 1 time/1 minute will be performed in the state of this initial operation (13th step ST<sub>13</sub>). Then, for right repair of an abnormal operation state motor or exchange, it connects with the website 32 of the contractor in charge via the comprehensive supervising system 29, and processing of an order of a repair article, a repair request, the request for quotation of a new article, etc. is performed (15th step ST<sub>15</sub>).

[0037]It carries out based on the measuring result transmitted one by one from

the sensor element 2 attached to each motor in the comprehensive supervising system 29, The result of having synthesized the result after the alert of the advisory and alarm which were mentioned above, and repair is automatically created as a daily report and a monthly report, and it has become a system (16th step ST<sub>16</sub>) sent via the Internet etc.

[0038]The measuring result and failure information which were accumulated in the comprehensive supervising system over the long period of time are accumulated as a database, and the fault prediction information judged on a mid- and long-term basis is created by comparing the measuring result transmitted one by one from the sensor element 2, and this database.

[0039]It sends with the creation of a report and the creation of dispatch and fault prediction information which have been described above, A predetermined fee can also be charged at a contractor to service acts in connection with the maintenance and new installation which were interlocked with transmission and reception of the variety of information in connection with an operation condition, and the operation condition of apparatus, such as automatic processing of automatic information gathering, order, etc.

[0040]It makes it good to use the fault predicting system using the self-study method whose decision precision concerning the operating status of apparatus improves, so that the data accumulation amount of CPU to which above-mentioned fault prediction information is made to output increases. Issue of the data which totals in periods, such as a daily report and a monthly report, is also largely undertaken to the accumulation apparatus of data, and data calculation, analysis and a determining function.

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[Translation done.]

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DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1] They are a remote monitoring system of the industrial equipment which is an example of 1 gestalt of this invention, and an overall distribution diagram of the device.

[Drawing 2] It is a distribution diagram showing the example of 1 gestalt of the communication system to which the remote monitoring system of the industrial equipment of this invention and its device are applied.

[Drawing 3] It is a distribution diagram showing the example of 1 gestalt of other communication systems applied to the remote monitoring system of the industrial equipment of this invention, and its device.

[Drawing 4] It is a flow chart for system action explanation of this invention.

[Description of Notations]

1 [ .... Radio receiver-transmitter, ] .... Surveillance object apparatus, 2 .... A sensor element, 3 .... A preamplifier, 4 5 .... Amplifier, 10 .... A microcomputer (CPU<sub>1</sub>), 11, 18 .... Memory, 13 .... A transmitter-receiver, 17 .... Microcomputer (CPU<sub>2</sub>), 21 .... An equipment management person, 25 .... A PHS transmitter-receiver, 26 .... Terminal, 27 [ .... Communication line, ] .... A translator, 28 .... PBX, 29 .... A comprehensive supervising system, 30 30a [ .... A PHS terminal, 34 / .... A public PHS circuit, 35 / .... A public ISDN circuit, 36 / .... DSU, 37 / .... Terminal adopter ] .... A public line (Internet), 31 .... The information terminal equipment, 32 which a contractor holds .... Websites, such as a maintenance dealer, 33

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[Translation done.]

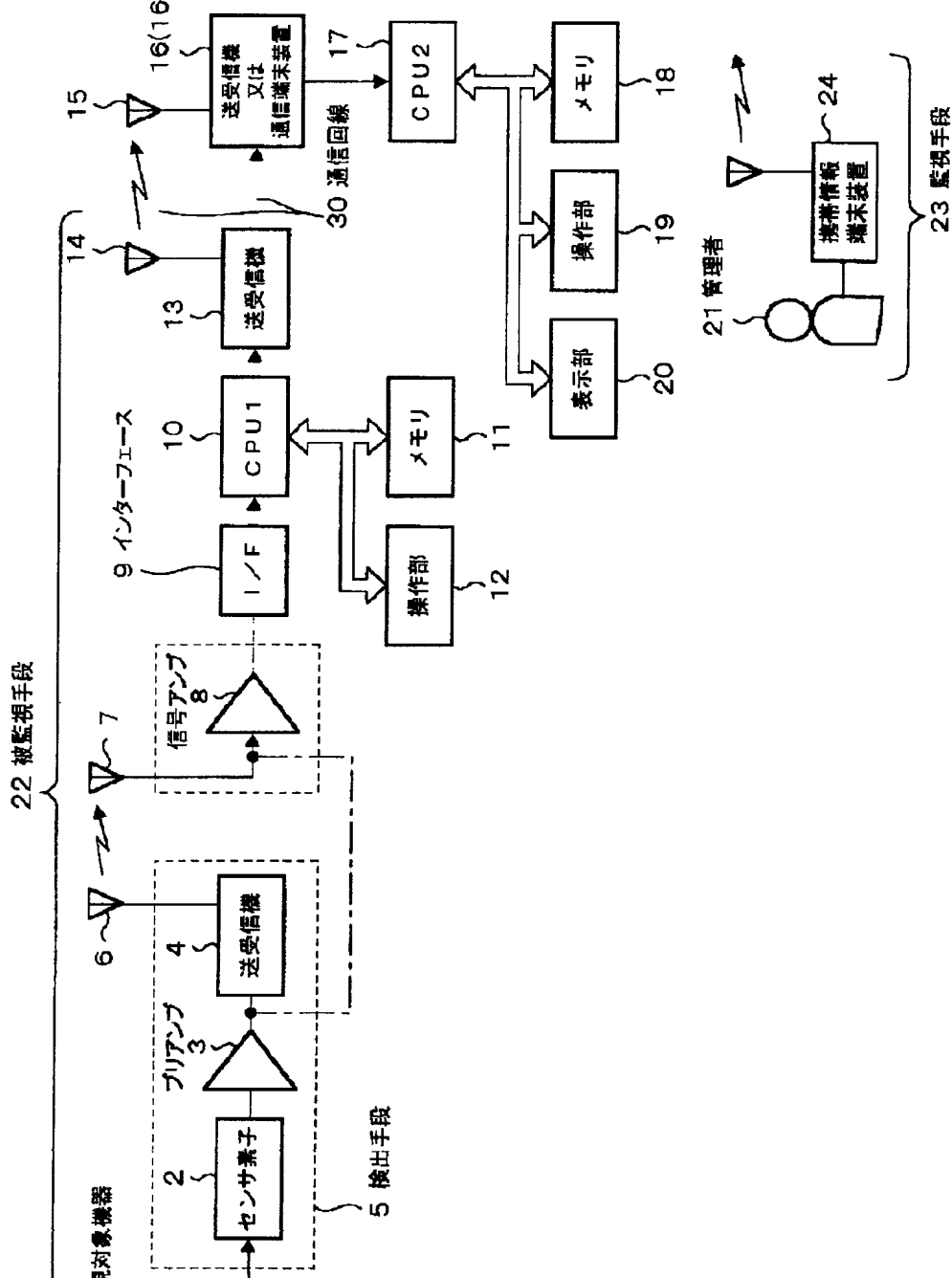
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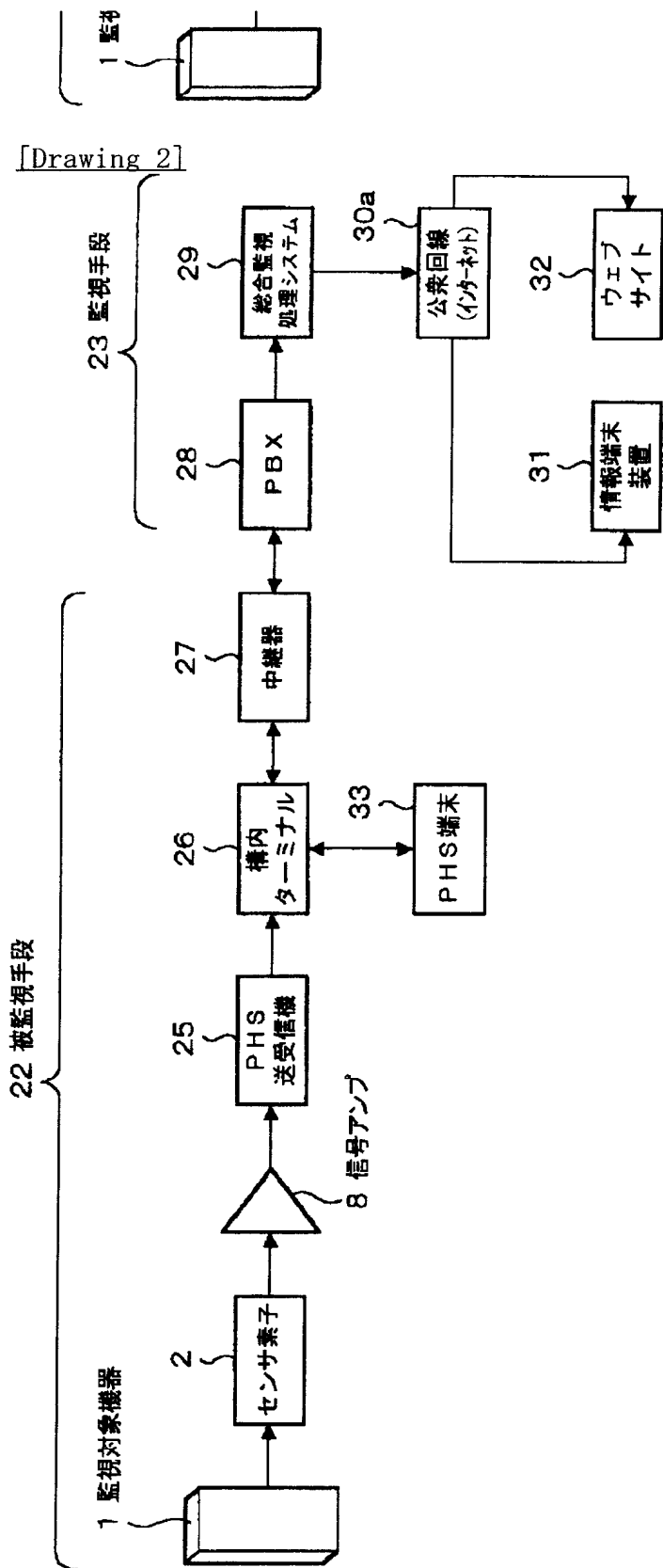
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## DRAWINGS

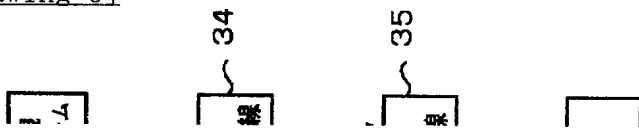
[Drawing 1]

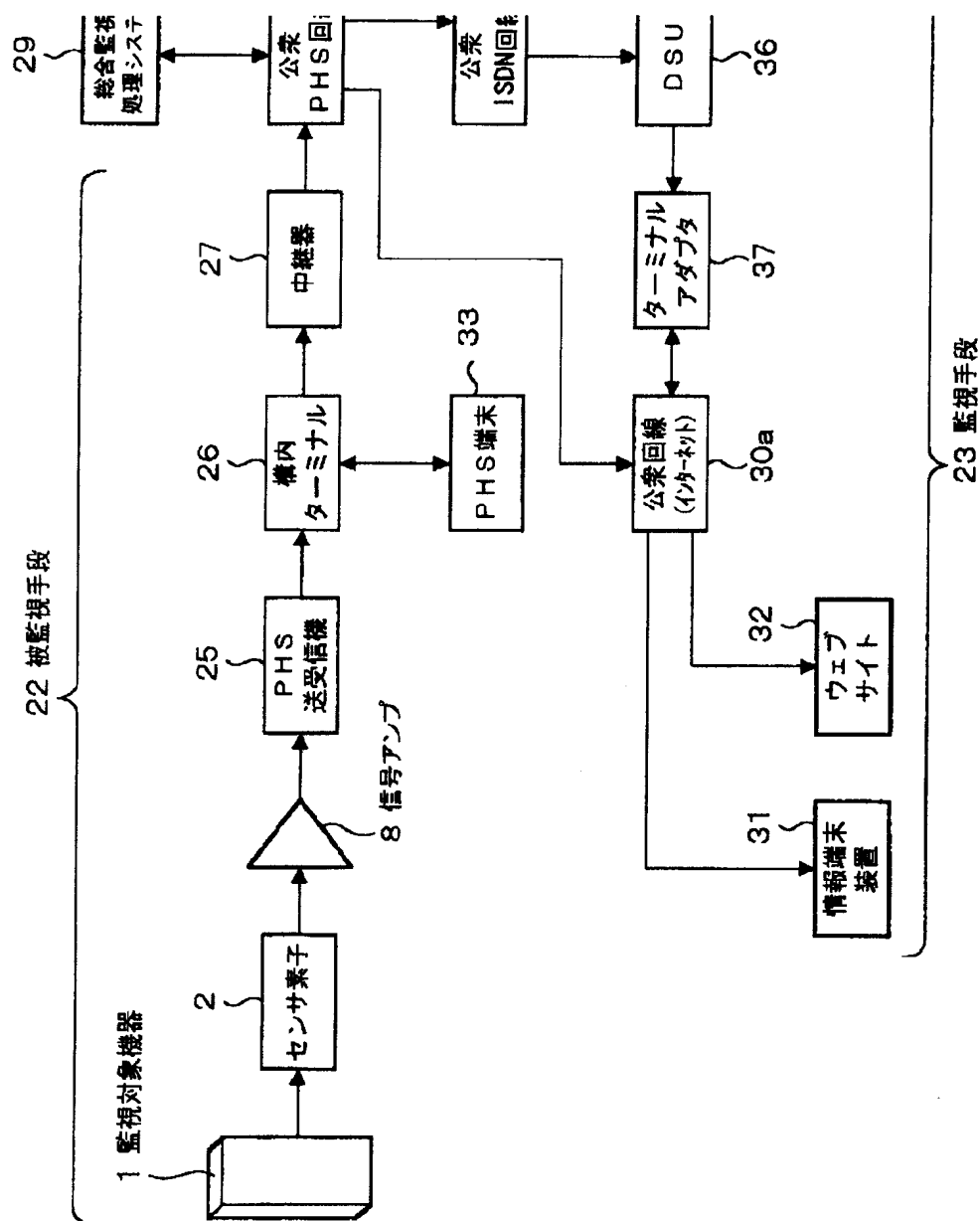




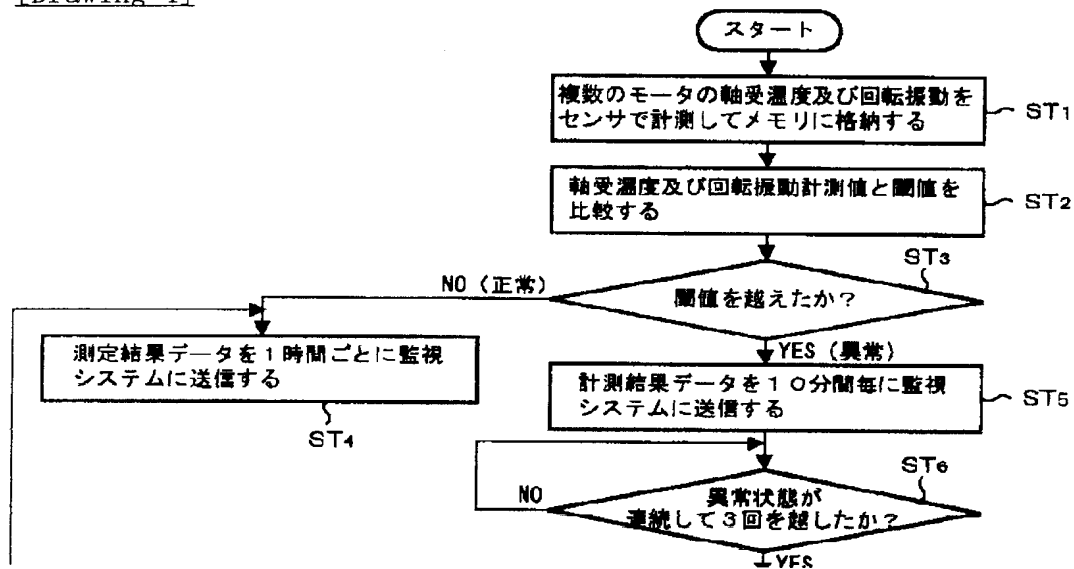


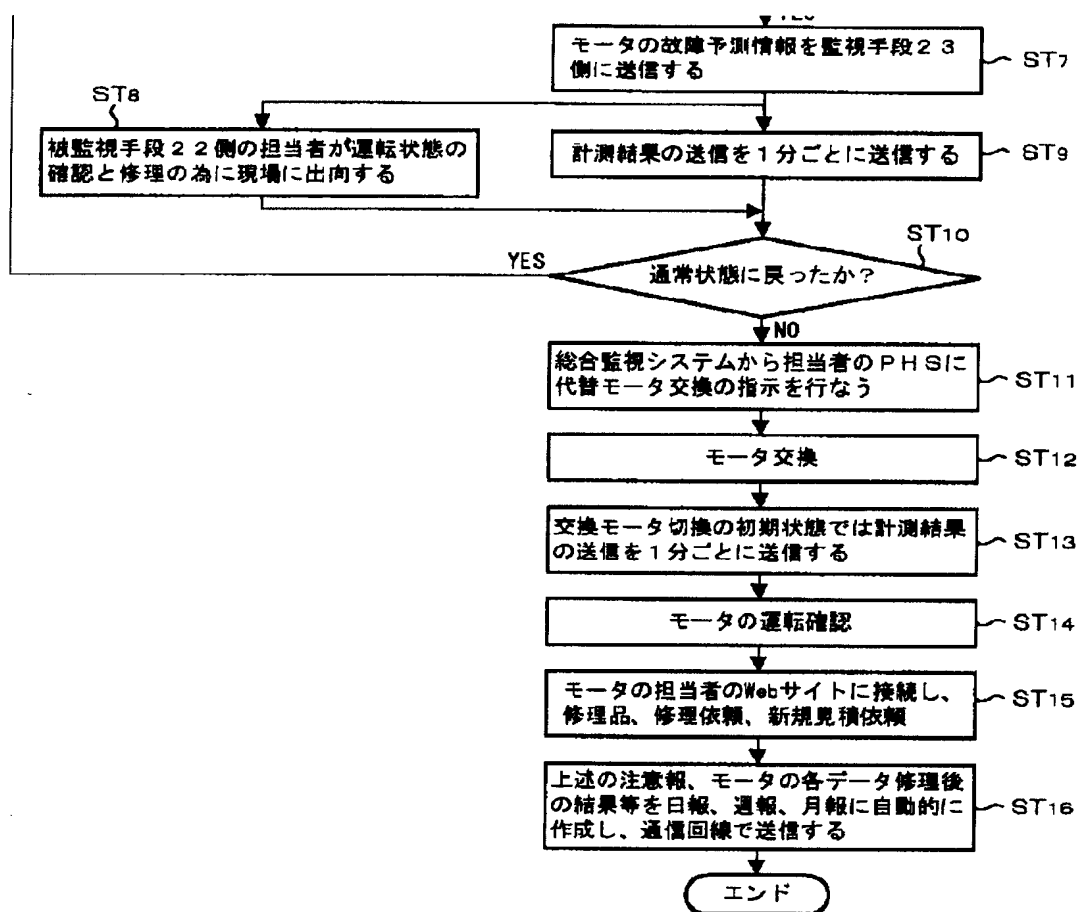
[Drawing 3]





[Drawing 4]





[Translation done.]